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Further Investigations of The Martian Surface 2001-2003

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MSP'01 Science

The Role of 2001 Orbiter Science in the Mars Program

- **Global map of elemental abundance**
  - **Hydrogen abundance map indicates near-surface water**
- **Global map of mineralogy**
  - **300 m resolution to find evaporites or minerals with biologic potential for sample return site selection**
- **Color imaging at 20 m resolution**
- **Characterize Mars radiation environment for future human exploration**

Payload Assignments

- **The Mars Surveyor Program 2001 Payload Is Assigned to the Flight System Elements as Follows:**
  - **The orbiter science payload shall consist of:**
    - **Gamma Ray Spectrometer (GRS)**
    - **Thermal Emission Imaging System (THEMIS)**
    - **Mars Radiation Environment Experiment (MARIE)**

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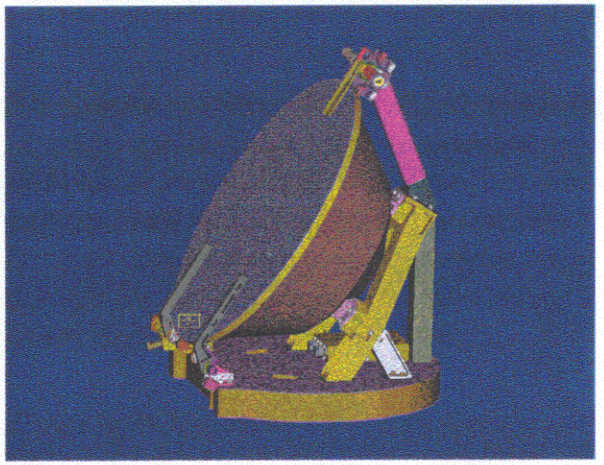
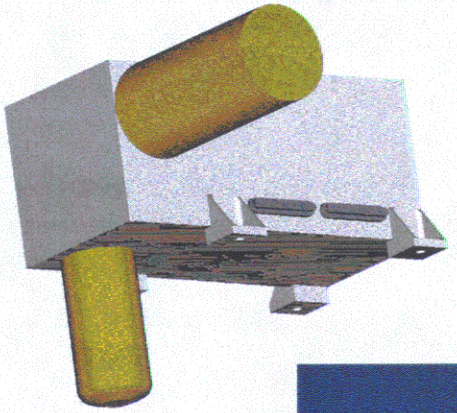
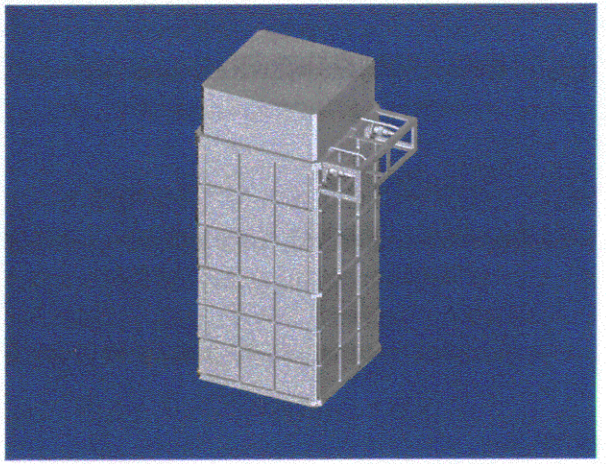
Gamma-Ray Spectrometer (GRS)

Gamma Sensor Head





High Energy Neutron Detector



Neutron Spectrometer

OBJECTIVES: Full planet mapping of elemental abundance with an accuracy of 10% or better and a spatial resolution of about 300 km, by remote gamma-ray spectroscopy, and full planet mapping of the hydrogen (with depth of water inferred) and CO2 abundances by remote neutron spectroscopy

SCIENCE TEAM: PI is William Boynton. Co-I's are James Arnold, Peter Englert, William Feldman, Albert Metzger, Steve Squyres, Jacob Trombka, Heinrich Waenke, (Claude d'Uston-TBD). HEND PI is Igor Mitrofanov.

SUPPLIERS: U of Arizona, LANL, A.D. Little, Eurisys Measures (France), and IKI (Russian Space Research Institute). Hop Bailey is Instr. Mgr.

HARDWARE: GRS sensor head with 85 K cooler, neutron spectrometer (NS), & high energy neutron detector (HEND). Cooler FOV = 170˚. Energy range is 0.2 to 16 MeV. CPU = 386.

INTERFACE: Mass = 30.1 kg. Power = 27.6 W. Volume = 48 dia. x 26 cm gamma sensor head, 13 x 13 x 29 cm NS, 27 x 22 x 19.2 cm HEND. Data rate = 2.5kbsp. 100˚C annealing. 6 m boom. S/C materials usage requirements

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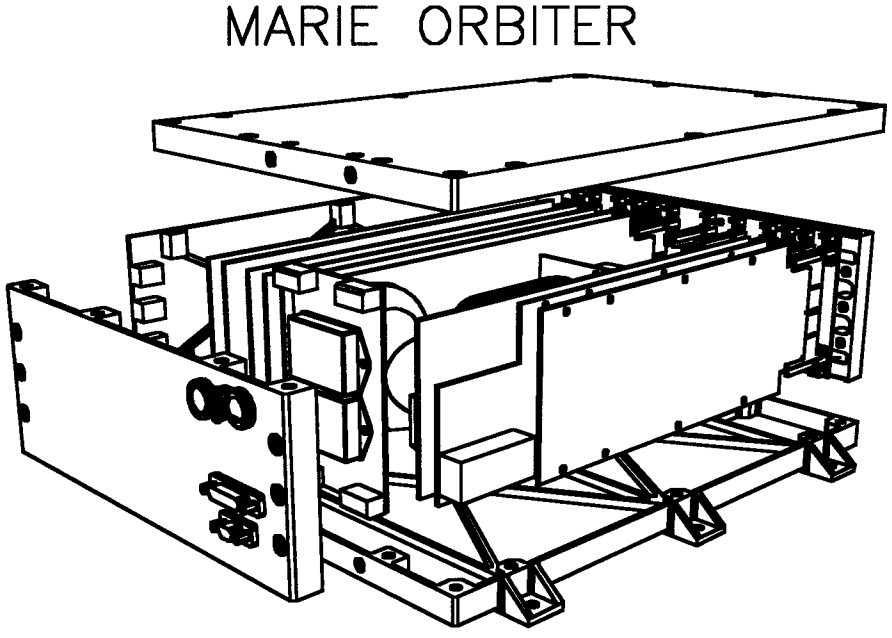
Martian Radiation Environment Experiment (MARIE)



OBJECTIVES: Orbiter MARIE - Characterize specific aspects of near-space radiation environment, characterize the surface radiation environment as related to radiation-induced risk to human exploration, and determine and model effects of the atmosphere in an attempt to predict anticipated doses and assess its radiobiological effectiveness.

SCIENCE TEAM: PI is Gautam Badhwar (JSC).

SUPPLIERS: JSC. Robert Dunn is the Instrument Manager. Subcontractors are Lockheed Martin and Battelle Pacific Northwest.

HARDWARE: Energetic particle spectrometer, 56° FOV, 2 silicon detectors 25.4 x 25.4 mm, 120 MB flash memory, Intel processor. Measures SEP events from 15 to 500 MeV/nucleon.

INTERFACE: Mass = 4.0 kg. Power = 7 W. Volume = 10.8H x 29.4L x 23.2Wcm. Data rate is 3 Mbits per day over RS-422 low speed data line.

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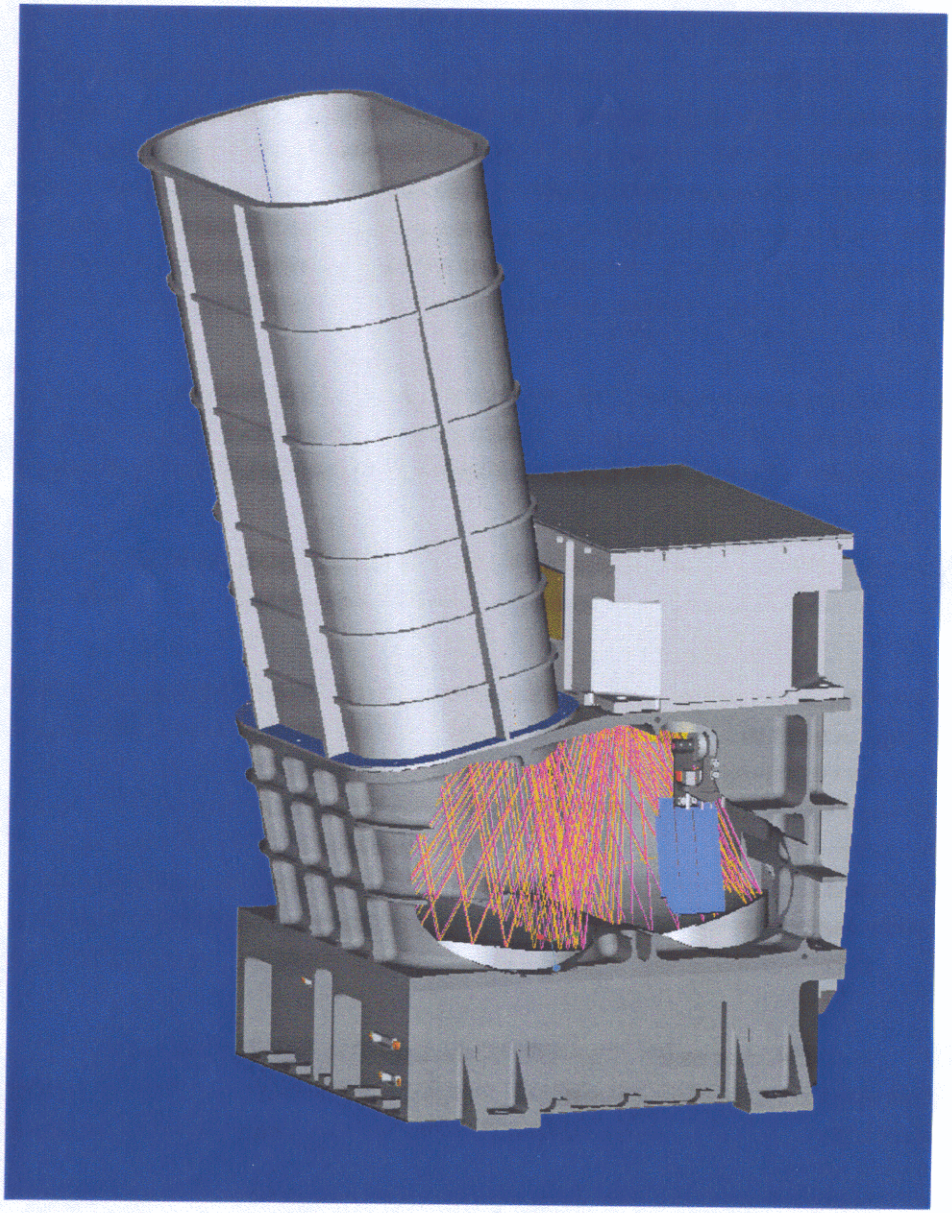
Thermal Emission Imaging System (THEMIS)



OBJECTIVES: Determine the mineralogical composition of the surface for minerals whose abundance is approximately 10% or greater and at spatial scales of approximately 100 m. Provide information on the morphology of the surface such that features significantly less than 100 m can be adequately resolved.

SCIENCE TEAM: PI is Philip Christensen (ASU). Co-I's are Bruce Jakosky, Hugh Kieffer, Mike Malin, Harry McSween, and Kenneth Nealson.

SUPPLIERS: Arizona State U, SBRS, MSSS. Greg Mehall is the Instrument Manager.

HARDWARE: Multi-spectral IR imager, visible imager (M98 heritage), 3 mirror, 20 cm focal length, f/1.7 anastigmat telescope, 4.6° (along track) by 3.5° (downtrack) IR FOV, 2.9° x 2.9° Vis FOV. Resolution = 80 m (IR) and 20 m (VIS). Spectral Range = 6.5 to 15.5μ (IR) and 0.425 to 0.8 μ (Vis). Detectors are 320 x 240 pixels (IR) & 1024 x 1024 pixels (VIS).

INTERFACE: Mass = 12.8 kg. Power = 17 W. Volume = 55.8L x 37.9H x 28.0W cm. Uses 2 high speed RS-422 data lines.

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MSP '01 Orbiter

The Mars Surveyor 2001 Orbiter is scheduled for launch on March 30, 2001. It will arrive at Mars on Oct. 20, 2001, if launched on schedule. After a propulsive maneuver into a 25-hour capture orbit, aerobraking will be used over the next 76 days to achieve the 2-hour science orbit. Aerobraking was utilized on the Mars Global Surveyor and Mars Climate Orbiter missions. The Orbiter will carry 3 science instruments, the Thermal Emission Imaging System (THEMIS), the Gamma Ray Spectrometer (GRS), and the Mars Radiation Environment Experiment (MARIE). THEMIS will map the mineralogy and morphology of Martian surface using a high-resolution camera and a thermal infrared imaging spectrometer. The GRS will achieve global mapping of the elemental composition of the surface and determine the abundance of hydrogen in the shallow subsurface. The GRS is a rebuild of the instrument lost with the Mars Observer mission. The MARIE will characterize aspects of the near-space radiation environment as related to the radiation-related risk to human explorers. It will be used in conjunction with a similar instrument on the '01 Lander to determine and model the effects of the atmosphere on the radiation-induced hazard on the surface. The 2001 Orbiter will also support communication with the '01 Lander scheduled to arrive on Jan. 22, 2002.